10.2 Fiber Bragg Gratings

In 1978, Hill and coworkers [154] at the Communications Research Center of Canada obtained some surprising experimental results while studying the nonlinear properties of a special fiber using blue light. They hypothesized and later proved that the phenomenon they were observing was caused by the writing of a relatively permanent, photoinduced index grating in the glass fiber itself. This was the birth of a new technology now known as Fiber Bragg Gratings (FBGs). In this section we cover some of the properties and applications of such gratings. For an excellent review of this field, see [294].

Much additional work by many individuals took place before FBGs became a commercial reality. Some of this work included the use of UV lasers for writing the gratings, the photosensitization of the glass by diffusion of molecular hydrogen into a standard fiber before exposure, and the use of phase masks for creating the proper interfering beams during exposure. The reader is referred to the article cited above for a more detailed recounting of the history of this technology. It is now possible to induce essentially permanent refractive index changes of magnitude 10^{-4} to 10^{-2} in a glass fiber using these methods.

A FBG is basically a thick hologram recorded down the length of a section of glass fiber. The chief advantage of a FBG arises from the fact that the grating resides in a fiber, which can be spliced to ordinary fiber, and therefore provides a compact and low-loss method for introducing in-fiber devices such as narrowband filters, dispersion compensators, and other types of filter structures.